

(1) The inlet faces upstream in the primary dilution tunnel at a point where the primary dilution air and exhaust are well mixed (*i.e.*, on the primary tunnel centerline, approximately 10 tunnel diameters downstream of the point where the exhaust enters the primary dilution tunnel).

(2) The particulate sample exits on the centerline of the secondary tunnel and points downstream.

(B) The particulate sample transfer tube shall be:

(1) Sufficiently distant (radially) from other sampling probes (in the primary dilution tunnel) so as to be free from the influence of any wakes or eddies produced by the other probes.

(2) 0.5 in (1.3 cm) minimum inside diameter.

(3) No longer than 36 in (91 cm) from inlet plane to exit plane.

(4) Designed to minimize the deposition of particulate during transfer (*i.e.*, bends should be as gradual as possible, protrusions (due to sensors, etc.) should be smooth and not sudden, etc.).

(5) Constructed of electrically conductive material which does not react with the exhaust components, and electrically grounded.

(C) The secondary dilution air shall be at a temperature of 77 ± 9 °F (25 ± 5 °C). For the first 10 seconds this specification is 77 ± 20 °F (25 ± 11 °C).

(D) The secondary-dilution tunnel shall be:

(1) 3.0 inches (7.6 cm) minimum inside diameter.

(2) Of sufficient length so as to provide a residence time of at least 0.25 seconds for the double-diluted sample.

(3) Constructed of electrically conductive material which does not react with the exhaust components, and electrically grounded.

(E) Additional dilution air must be provided so as to maintain a sample temperature of 125 °F (51.7 °C) or less immediately before the primary sample filter.

(F) The primary filter holder shall be located within 12.0 in (30.5 cm) of the exit of the secondary dilution tunnel.

(G) Other sample flow handling and/or measurement systems may be used if shown to yield equivalent results and if approved in advance by the Administrator.

(7) *Particulate sampling filters.* (i) Fluorocarbon-coated glass fiber filters or fluorocarbon-based (membrane) filters are required.

(ii) Particulate filters must have a minimum diameter of 70 mm (60 mm stain diameter). Larger diameter filters are acceptable.

(iii) The dilute exhaust will be simultaneously sampled by a pair of filters (one primary and one back-up filter) during the cold-start test and by a second pair of filters during the hot-start test. The back-up filter holder shall be located no more than 4 inches (10 cm) downstream of the primary filter holder. The primary and back-up filters shall not be in contact with each other.

(iv) It is recommended that the filter loading should be maximized consistent with other temperature requirements and the requirement to avoid moisture condensation. A filter pair loading of 1 mg is typically proportional to a 0.1 g/bhp-hr emission level. All particulate filters, reference filters, and background filters shall be handled in pairs during all weighing operations for emissions testing.

(8) *Methanol sampling system.* The methanol sampling system, shown in Figure N90-2, consists of impingers (or sample collection capsules) containing known volumes of deionized water and sampling pump to draw the proportional sample through the impingers.

(9) *Formaldehyde sampling system.* The formaldehyde sampling system, Figure N90-3, consists of sample collection impingers and sampling pump to draw the proportional sample through the impingers.

[54 FR 14578, Apr. 11, 1989, as amended at 59 FR 48525, Sept. 21, 1994; 60 FR 34370, June 30, 1995; 62 FR 47124, Sept. 5, 1997]

§ 86.1311-90 Exhaust gas analytical system; CVS bag sample.

(a) *Schematic drawings.* Figure N90-9 is a schematic drawing of the exhaust gas analytical system used for analyzing CVS bag samples from either Otto-cycle or diesel engines. Since various configurations can produce accurate results, exact conformance with the drawing is not required. Additional components such as instruments, valves, solenoids, pumps and switches

may be used to provide additional information and coordinate the functions of the component systems. Other components such as snubbers, which are

not needed to maintain accuracy in some systems, may be excluded if their exclusion is based upon good engineering judgment.

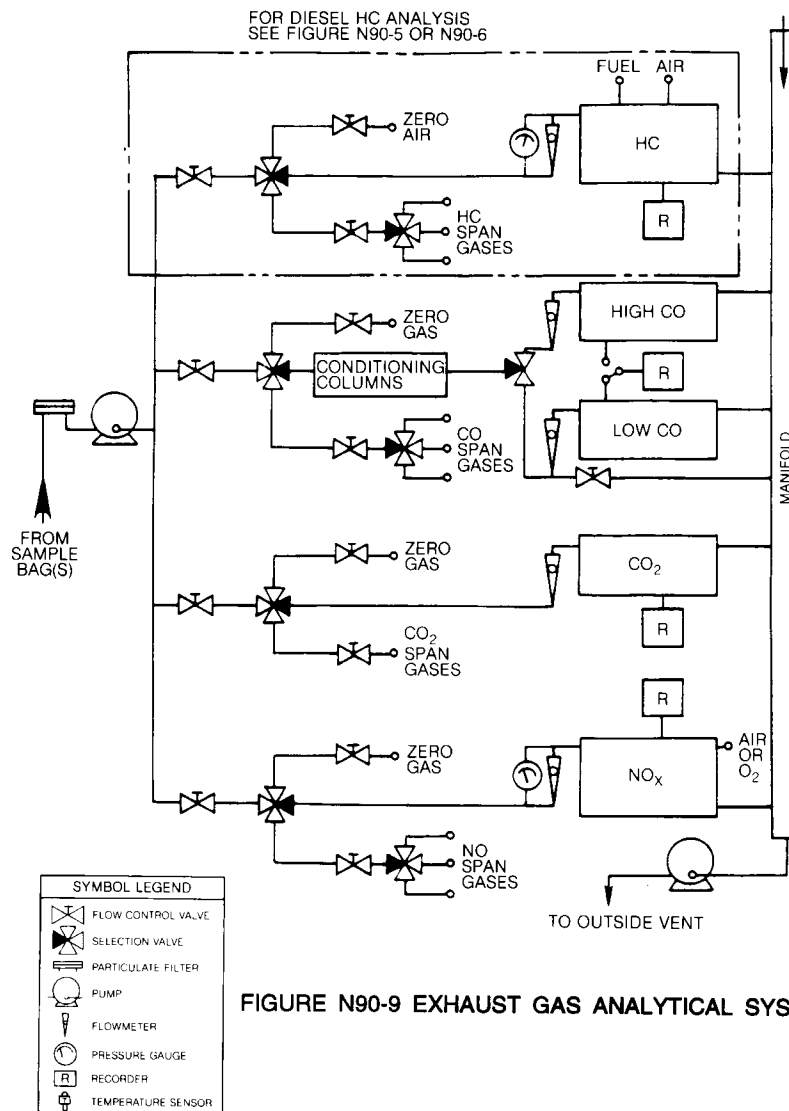


FIGURE N90-9 EXHAUST GAS ANALYTICAL SYSTEM

(b) *Major component description.* The analytical system, Figure N90-9, consists of a flame ionization detector

(FID) (heated for methanol-fueled (235±15 °F (113±8 °C)) and for petroleum-

fueled diesel (375 ± 10 °F (191 ± 6 °C) engines) for the measurement of hydrocarbons, nondispersive infrared analyzers (NDIR) for the measurement of carbon monoxide and carbon dioxide, and a chemiluminescence analyzer (CL) for the measurement of oxides of nitrogen. The analytical system for methanol consists of a gas chromatograph (GC), equipped with a flame ionization detector. The analysis for formaldehyde is performed using high pressure liquid chromatography (HPLC) of 2,4-dinitrophenylhydrazine (DNPH) derivatives using ultraviolet (UV) detection. The exhaust gas analytical system shall conform to the following requirements:

(1) The CL requires that the nitrogen dioxide present in the sample be converted to nitric oxide before analysis. Other types of analyzers may be used if shown to yield equivalent results and if approved in advance by the Administrator.

(2) The carbon monoxide (NDIR) analyzer may require a sample conditioning column containing CaSO_4 , or dessicating silica gel to remove water vapor, and containing ascarite to remove carbon dioxide from the CO analysis stream.

(i) If CO instruments are used which are essentially free of CO_2 and water vapor interference, the use of the conditioning column may be deleted. (See §§ 86.1322 and 86.1342.)

(ii) A CO instrument will be considered to be essentially free of CO_2 and water vapor interference if its response to a mixture of 3 percent CO_2 in N_2 , which has been bubbled through water at room temperature, produces an equivalent CO response, as measured on the most sensitive CO range, which is less than 1 percent of full scale CO concentration on ranges above 300 ppm full scale or less than 3 ppm on ranges below 300 ppm full scale. (See § 86.1322.)

(c) *Alternate analytical systems.* Analysis systems meeting the specifications of 40 CFR part 86 subpart D may be used for testing required under this subpart, with the exception of §§ 86.346 and 86.347, provided that the subpart D systems meet the specifications of this subpart. Heated analyzers may be used in their heated configuration.

(d) *Other analyzers and equipment.* Other types of analyzers and equipment may be used if shown to yield equivalent results and if approved in advance by the Administrator.

[54 FR 14578, Apr. 11, 1989]

§ 86.1311-94 Exhaust gas analytical system; CVS bag sample.

(a) *Schematic drawings.* Figure N94-1 is a schematic drawing of the exhaust gas analytical system used for analyzing CVS bag samples from either Otto-cycle or diesel engines. Since various configurations can produce accurate results, exact conformance with the drawing is not required. Additional components such as instruments, valves, solenoids, pumps and switches may be used to provide additional information and coordinate the functions of the component systems. Other components such as snubbers, which are not needed to maintain accuracy in some systems, may be excluded if their exclusion is based upon good engineering judgment.

(b) *Major component description.* The analytical system, Figure N94-1, consists of a flame ionization detector (FID) (heated for methanol-fueled (235 ± 15 °F (113 ± 8 °C)) and for petroleum-fueled diesel (375 ± 10 °F (191 ± 6 °C) engines) for the measurement of hydrocarbons, a methane analyzer (consisting of a gas chromatograph combined with a FID) for the determination of CH_4 (for engines subject to NMHC standards, where applicable), nondispersive infrared analyzers (NDIR) for the measurement of carbon monoxide and carbon dioxide, and a chemiluminescence analyzer (CL) for the measurement of oxides of nitrogen. The analytical system for methanol consists of a gas chromatograph (GC), equipped with a flame ionization detector. The analysis for formaldehyde is performed using high pressure liquid chromatography (HPLC) of 2,4-dinitrophenylhydrazine (DNPH) derivatives using ultraviolet (UV) detection. The exhaust gas analytical system shall conform to the following requirements:

(1) The CL requires that the nitrogen dioxide present in the sample be converted to nitric oxide before analysis. Other types of analyzers may be used if shown to yield equivalent results and if